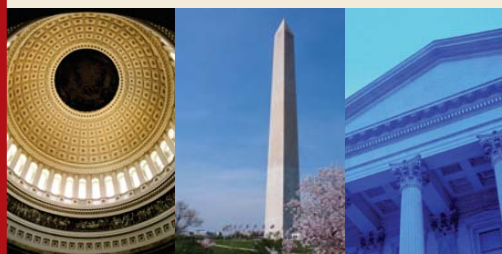


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books

any individual topic, as he acknowledges in his preface. That is acceptable for many courses and is highly desirable for engineering undergraduate students. But graduate students and those seeking to fully understand the associated physics or appreciate the origins of methodological approximations will need to consult other sources.

Some of the material included in the appendices at the back of the book—for example, on units and energy conversions—can be readily found elsewhere. I also question the need for an appendix to introduce readers to materials science: Any readers lacking the basic knowledge summarized too briefly there will most likely struggle with many of the topics covered in the book. In contrast, the appendices that provide overviews of mathematical concepts and classical mechanics will enhance the text for nonexperts.

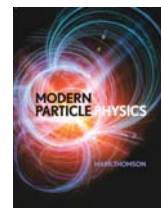
These criticisms don't appreciably detract from the overall utility of the book. *Introduction to Computational Materials Science* offers one of the more accessible recent overviews of an increasingly popular field. I expect it will become a favorite of many students and instructors.

Susan B. Sinnott
University of Florida
Gainesville

Modern Particle Physics

Mark Thomson
Cambridge U. Press, 2013. \$75.00
(554 pp.). ISBN 978-1-107-03426-6

Like researchers preparing a talk and lecturers preparing a course, authors must make difficult choices when writing a textbook: What level should be strived for, what must be included, what can be left out? For the most part, I believe University of Cambridge professor Mark Thomson made excellent choices in his text *Modern Particle Physics*. The book is aimed at upper-level undergraduates or graduate students. It assumes just a basic knowledge of quantum mechanics and special relativity, but it's more advanced than such modern-day classics as David Griffiths's *Introduction to Elementary Particles* (2nd edition, Wiley, 2008) or Francis Halzen and Alan Martin's *Quarks and Leptons: An Introductory Course in Modern Particle Physics* (Wiley, 1984).



Particle physics is a difficult subject to cover in a textbook. It has a long history, and as is true throughout physics, new discoveries are still being made. Furthermore, that particle physics is based on rich mathematics makes it impossible to describe without, for example, group theory. The discipline is grounded in quantum field theory, which students seldom take before encountering a particle-physics course. The author must develop an abridged version so as to convey the science.

I would recommend Thomson's text to any physicist interested in learning the subject. It contains excellent physical explanations that help make it useful as a self-study guide or for a year-long course. The excellent mix of theory and phenomenology requires that the chapters be consumed in sequence. That makes the book less suitable for a one-semester undergraduate physics course with time for only a few selected topics. However, it would still be a very useful companion text for such a course.

Many authors start with a historical treatment, beginning with J. J. Thomson's discovery of the electron in 1897. But author Mark Thomson forgoes the historical route to present the material more coherently. After a short overview of the standard model of particle physics, he delves into how particles interact with matter and provides a short description of the different detector technologies used in modern experiments. The nod to detectors is a nice addition, given that many similar texts do not discuss experimental issues at all. But I would have liked to see it expanded to include a discussion of how experimentalists use triggers, collect data, and re-create tracks to enable physics analyses. The book goes on to cover aspects of the standard model, based almost exclusively on tree-level (lowest perturbative order) properties. Only in a few places where higher-order loop effects are crucial are they discussed, which is perfectly reasonable for a book at the level the author is shooting for.

Throughout the text, just enough mathematics is introduced to facilitate the presentation of theory and phenomenology. Thomson has an excellent ability to explain physics and pull it out of the math. For instance, starting with perturbation theory he motivates the use of Feynman diagrams, usually derived from path integrals. Later, he uses helicity amplitudes to evaluate matrix elements. A practitioner would usually not do the calculation in that way, but

Thomson uses it to elucidate some of the physical aspects that would be hidden in the standard trace formalism (which he introduces in an optional section). A less successful explanation is given for the Higgs mechanism, in which the Lagrangians that suddenly appear increase the complexity and cloud the physics for the initiate.

Thomson has experience in different experimental collaborations, including the ATLAS experiment at CERN's Large Hadron Collider and the Long-Baseline Neutrino Facility. Clearly his professional interests influenced the text, which focuses on the important topics of weak interactions, *CP* (charge conjugation plus parity) violation, and neutrino oscillations. He dedicates a short section to the Higgs discovery and also includes a discussion of the theoretical necessity for the Higgs mechanism to break electroweak symmetry.

It is surprising that *Modern Particle Physics* provides no substantive discussion of precision electroweak physics, rare B decays, or top-quark physics—topics in Thomson's research portfolio. The author devotes a section to open questions in particle physics, but it's too short. I understand the pedagogical reasoning behind those choices, but given the current state of particle physics, I think it is particularly important for texts to develop physics beyond the standard model. All of the model's particle content has now been found, and yet mysteries remain. Given Thomson's excellent presentation of the material he covered, I would have liked to see his exposition of those puzzles as well.

Adam Leibovich

*University of Pittsburgh
Pittsburgh, Pennsylvania*

Wizards, Aliens, and Starships Physics and Math in Fantasy and Science Fiction

Charles L. Adler
Princeton U. Press, 2014. \$29.95
(378 pp.). ISBN 978-0-691-14715-4

Wizards, Aliens, and Starships: Physics and Math in Fantasy and Science Fiction is a fascinating book. As I started to read it, what immediately caught my attention was the passion and excitement that author Charles Adler instills in the text. I couldn't put it down.

Adler's goal is to explain the feasibility of some physics underlying popular works of science fiction and fantasy, in books and in films. His enthusiasm for

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**ALL APPLICATION
MATERIALS MUST BE
SUBMITTED ONLINE BY
CLOSE OF BUSINESS
ON JANUARY 15, 2015
(5:00 PM EST).**